Important Advances in Clinical Medicine

Epitomes of Progress—Radiology

The Scientific Board of the California Medical Association presents the following inventory of items of progress in Radiology. Each item, in the judgment of a panel of knowledgeable physicians, has recently become reasonably firmly established, both as to scientific fact and important clinical significance. The items are presented in simple epitome and an authoritative reference, both to the item itself and to the subject as a whole, is generally given for those who may be unfamiliar with a particular item. The purpose is to assist the busy practitioner, student, research worker or scholar to stay abreast of these items of progress in Radiology which have recently achieved a substantial degree of authoritative acceptance, whether in his own field of special interest or another.

The items of progress listed below were selected by the Advisory Panel to the Section on Radiology of the California Medical Association and the summaries were prepared under its direction.

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Computed Cerebral Tomography

COMPUTED TOMOGRAPHY (CT) is a new radiologic technique which was introduced in England in 1970. The first units to be installed in California have been operational for only a few months; by the latter part of 1974 there were six functioning scanners in the state. Using cerebral computed tomography, we are able for the first time to obtain precise information about the brain using a noninvasive procedure. The use of this technique will have a profound effect upon the neurosciences.

The technique of computed tomography is quite unlike that used in conventional radiography—a narrow beam of x-rays is passed through the head and is detected by sensing devices which always remain in alignment with the x-ray source. Both the x-ray tube and the detectors traverse the patient's head linearly, taking multiple readings of transmission. The x-ray scanning unit is then rotated around the head and the process is repeated: 28,800 readings are obtained from 180 traverses. These readings are then processed by a small computer which calculates absorption values, thus providing a measure of the density of numerous small regions of tissue within a "slice" of the head. The system yields much more information on brain tissue than does conventional x-ray examination and can distinguish small variations in tissue density. Irradiation of the skin is confined to the narrow band of the "slice" and the integral dose from a single complete scan is likely to be less than that from a single roentgenogram of the skull.

From the calculations done by the computer, a picture is built up in the form of a matrix of many points. The matrix is shown on a cathode ray tube viewing unit and is also printed out numerically. The data may also be stored on magnetic tape for subsequent analysis or regeneration of the cathode ray tube display. The latter is readily photographed by an attached camera system. During

an examination by CT the patient is required to remain immobile for several minutes. Restless patients and children may require sedation to minimize movement. With present equipment, 12 to 15 patients can be examined in a ten-hour day, but with anticipated technical improvements, this patient volume may be increased.

The ultimate resolution of the instrument is determined by the physical characteristics; with the 80 by 80 matrix that has been standard until just recently, the computer calculates the results in a three mm square with a thickness that can be varied from 8 to 13 mm, with 13 mm being the accepted standard. The new high resolution option, recently available, has a 160 by 160 matrix so that the computer will be looking at squares half the size of the original. There are other improvements included with the high resolution option which it is hoped will contribute to lessening the rate of error. A modification of the technique of examination which will contribute to a reduction in the error rate is the use of contrast enhancement; this is proving to be especially helpful in certain meningiomas, smaller acoustic neurinomas, metastasis and arterial venous malformation. Other factors which limit resolution are (1) motion and (2) physical factors at the skull base, in the posterior fossa and at the convexity. Lesions which are least likely to be detected by current CT techniques fall into two categories: (1) small lesions involving or adjacent to the hypothalamus, optic chiasm and optic nerve, and in the cerebellopontine angle and (2) primary vascular lesions, whether looking for the source of subarachnoid hemorrhage or occlusive disease (the CT scan may show the infarct but will give no specific information about the condition of the vessel).

The accuracy of this technique in its initial evaluation has been very promising. In the first 500 patients examined at the Mayo Clinic, the error rate was 3.6 percent (of the patients in this series who had other neuroradiological studies done, the corresponding error rates were pneumoencephalography, 2.1 percent; angiography, 6.5 percent, and isotope scans, 35 percent). There are certain lesions which have a characteristic pattern allowing a specific diagnosis. These include epidural and intracerebral hematoma; porencephalic, colloid and epidermoid cysts; cystic craniopharyngioma and cholesteatoma and pineoloma. The CT scan will be of particular value with trauma patients: intracerebral hematomas can be very easily differentiated from contusion, laceration and edema. There are other conditions in which the Mayo group found a high degree of diagnostic correlation (hydrencephalus, 92 percent; metastasis, 69 percent; dementia or degenerative states, 67 percent, suspected mass lesion, 62 percent, and infarction, 48 percent).

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Endoscopic Pancreaticholangiography (EPCG)

ENDOSCOPIC PANCREATICHOLANGIOGRAPHY (EPCG) provides valuable diagnostic information in patients with diseases of the pancreas and biliary tree. A side-viewing fiberoptic endoscope is visually directed into the duodenum and the papilla of Vater identified and cannulated with a flexible polyethylene tube. Injection of roentgenographic contrast material and fluoroscopic spot filming shows the anatomy of the pancreatic and biliary ducts.

EPCG is indicated in patients with (1) abdominal pain of unknown cause to corroborate a suspicion of pancreatic disease, (2) chronic relapsing pancreatitis for evaluation of possible surgical intervention, (3) suspected pancreatic carcinoma—patients with pancreatograms suspicious of carcinoma may undergo repeat cannulation for aspiration-cytology of pancreatic secretions, (4) obstructive jaundice—unlike transhepatic cholangiography, EPCG does not require immediate laparotomy and (5) postcholecystectomy syndromes.

Hazards of EPCG include those associated with any endoscopic procedure. In up to 45 percent of patients who undergo endoscopic pancreatography, there will be a transient elevation of serum amalyse without evidence of clinical pancreatitis. In approximately one percent of patients in this group, there will be clinically significant mild pancreatitis. EPCG is hazardous in patients with pancreatic pseudocyst because of the increased risk